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(54) Laundry treatment device having drying program and control method thereof

(57) A laundry treatment device having a drying program and a control method thereof is provided, wherein the laundry treatment device comprises a water tub, a rotatable drum disposed inside the water tub, a heating assembly for heating air into dry hot air, a condensing assembly for condensing moisture contained in relatively humid hot air, and a blowing device for driving an air circulation, wherein an air circulating loop is formed among the heating assembly, water tub, drum, condensing assembly and blowing device, and a spraying device for flushing the fluff accumulated on the condensing assembly is disposed between the condensing assembly and the blowing device. The water is sprayed from top down to the condensing assembly by the spraying device, thereby flushing away the fluff accumulated on the condensing assembly.

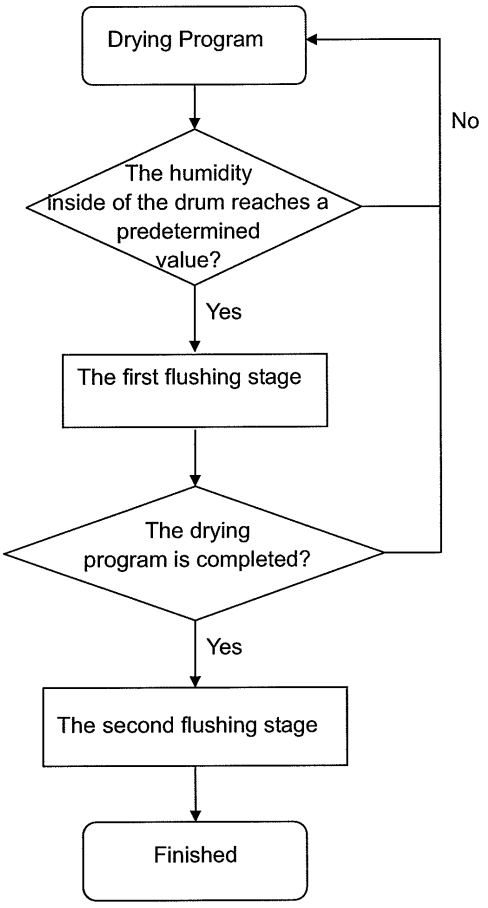

Fig.3

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Description

Technical Field

[0001] The present invention relates to a method for controlling a laundry treatment device, in particular to a method for controlling a laundry treatment device having a drying program.

Background of the Invention

[0002] As common laundry treatment devices, drum-type washers have become more and more popular with users due to their advantages of low damages to the laundry and water saving and so on. Generally, a common drum-type washer comprises a water tub and a rotatable drum disposed inside the water tub. To wash clothes, a user puts the clothes into the drum, and then the drum rotates under the drive of a motor and washing, rinsing and dewatering programs are carried out in turn, and the clothes are thus washed. However, a drum-type washing and drying machine is normally formed on the basis of a drum washing machine with the addition of a drying function so as to dry the dewatered laundry to realize the functions of washing and drying.

[0003] In the present invention, the laundry treatment device 1 which has a drying program can be either a drum-type washing and drying machine or a drum-type drying machine. Take the common drum-type washing and drying machine as an example below, its drying function is realized as follows: as shown in Fig. 1, the drum-type washing and drying machine comprises a water tub 2 and a rotatable drum 3 disposed inside the water tub 2, and a heating assembly 4 disposed above the water tub 2; the heating assembly 4 comprises heating device 8 and a heating channel 9; an outlet 10 of the heating channel 9 communicates with the inside of the water tub 2 and the drum 3 disposed within the water tub 2; air is heated by the heating device 8 into dry hot air which is transferred to the inside of the drum 3 via the heating channel 9, and heat exchange occurs between the dry hot air and the laundry inside the drum 3 so as to carry away the moisture in the laundry and to form relatively humid air; a condensing assembly 5 which comprises a condensing channel 11 and a condensing device 12 is disposed in a suitable place on one side of the water tub 2; an inlet 13 of the condensing channel 11 communicates with the water tub 2 and an outlet 14 thereof communicates with an inlet 15 of the heating channel 9; the heating channel 9, water tub 2, drum 3 and condensing channel 11 form an air circulating loop. In order to facilitate the air circulation, a blowing device 6 is disposed generally between the condensing device 12 and heating device 8; generally the blowing device 6 comprises a fan 16 and a motor 17 for driving the fan 16. Under the effect of the fan 16, the humid air formed after the heat exchange with the laundry enters into the condensing channel 11 via the inlet 13 of the condensing channel 11; by way of the condensing effects of the condensing device 12, the moisture in the humid air is condensed, and then condensed air re-enters into the heating channel 9 of the heating assembly 4 and is heated again by the heating device 8 and transferred to the drum 3. After several such cycles, the laundry is dried gradually. However, there exists in such a drum-type washing and drying machine the following problems: namely, during both the washing process and the drying process, especially during the drying process, it is inevitable for small waste items such as cotton linters, thrums, etc. (hereinafter referred to as "fluff") falling off from the laundry; and which, with the air flow, will adhere on the inlet 13 of the condensing channel 11 or onto surface of the condensing device 12, and even worse, it is possible for some of the fluff to enter the fan 16 of blowing device 6 via the condensing channel 11, or to enter the heating assembly 4. Over time and with the accumulation of the fluff, the condensing effect of the condensing device 12 and the operating efficiency of other assemblies such as the fan 16 are to be affected, and the drying efficiency of the laundry washing and drying machine will inevitably be reduced significantly.

[0004] In order to avoid adherence of the fluff, some drum-type washing and drying machines use the water flow of the rinsing program to flush away the attached fluff, so as to ensure they do not interfere with the air circulation. For example, in the drum-type washing and drying machine disclosed in Japanese patent publication no. 11-333185 (referring to pages 3 to 5 of the specification and Fig. 1), the rotation shaft of the drum within the water tub is substantially in the horizontal direction. The air circulation channel for its drying program is such that the air inside the water tub exits via an air discharge opening at lower side of the water tub, enters into the channel with a fan and a heater disposed therein, and then enters into the water tub via an opening of the channel located in the front side of the drum. To flush fluff accumulated at an air discharge hose connected with the air discharge opening, fill in water during the rinsing process till the water level is higher than the air discharge opening, thus a part of the water flows into the air discharge hose, and the water flow generated with the rotation of the drum will flush away the fluff attached to the air discharge opening and the air discharge hose. In addition, the wind pressure generated by the operation of the fan results in water level changes, which increases the amount of splashing of the water and can make the water splash into a dehumidification device connected with a drain hose, thereby flushing away the fluff attached to the dehumidification device. However, the above method for flushing the fluff still has the following problems: firstly, according to the solution disclosed in that patent publication, the flushing process is completed during the rinsing program, but generally the rinsing program precedes the drying program, and the generation of the fluff exists not only during the washing process but also during the drying process, especially during the drying process, and with the air circulation, the fluff will attach to the surface of the dehu-

midification device and even enter the fan and the heating channel. Therefore this method cannot flush away the fluff generated during the drying program, and therefore the method does not solve the problem of the reduced drying efficiency caused by the accumulation of the fluff during the drying program. Secondly, in that method, since it is necessary for the water level of a volume of water inflow to be higher than the air discharge opening of the water tub, and the water tub is connected with the air discharge opening and air discharge hose, when water is drained, the fluff that is flushed away in the rinsing program will flow back into the water tub with the water flow, and therefore it is quite possible for them to attach to the laundry and to spoil the laundry. Furthermore, in that method, since the fluff attaching to the dehumidification device are flushed away only by the water splashing from the top downwards, apparently the flushing effects are not very satisfactory.

Summary of the Invention

[0005] An object of the present invention aimed at solving the above problems, and is to provide a laundry treatment device having a drying program, so as to flush away the fluff accumulated on the condensing assembly, thereby ensuring the condensing effect of the condensing assembly, and further ensuring effectively the drying efficiency of the laundry washing device.

[0006] In order to realize the above object of the present invention, it is accomplished as follows: a laundry treatment device having a drying program, comprising a water tub, a rotatable drum disposed inside the water tub, a heating assembly for heating air into dry hot air, a condensing assembly for condensing moisture contained in relatively humid hot air, and a blowing device for driving air circulation, wherein an air circulating loop is formed among the heating assembly, water tub, drum, condensing assembly and blowing device, and a spraying device for flushing the fluff accumulated on the condensing assembly are disposed between the condensing assembly and the blowing device. Water is sprayed from top down to the condensing assembly by the spraying device, thereby flushes away the fluff accumulated on the condensing assembly.

[0007] Another object of the present invention is to provide a method for controlling the laundry treatment device, so as to solve the problem of low drying efficiency in the drying program caused by the accumulation of the fluff.

[0008] In order to realize the above object of the present invention, the method for controlling the laundry treatment device having a drying program is accomplished as follows: the laundry treatment device comprises a water tub, a rotatable drum disposed inside the water tub, a heating assembly for heating air into dry hot air, a condensing assembly for condensing the moisture contained in relatively humid hot air, and a blowing device for driving an air circulation; wherein an air circulating loop is formed among the heating assembly, water tub, drum, condensing assembly and blowing device; the drying program comprises a flushing program for flushing away the fluff accumulated on the condensing assembly. By way of the flushing program, the fluff accumulated on the surface of the condensing assembly are flushed away, thereby effectively ensuring the condensing effect of the condensing assembly, and at the same time effectively reducing the risk that the fluff enter the blowing device and the heating assembly via the condensing assembly, and solving the problem of low drying efficiency in the drying program of the laundry washing device caused by the accumulation of the fluff.

[0009] A preferred embodiment of the present invention further comprises, before the flushing program, a humidity detecting stage, wherein if the humidity detected in the humidity detecting stage reaches a predetermined humidity value, it enters the flushing program; otherwise, it continues with the drying program. Normally, the drying program and the laundry drying degree are controlled generally by timing device or humidity detecting device for detecting the humidity of the dried laundry, and according to the feedback signals from the timing device or humidity detecting device, it is determined whether the drying program is to be ended; in the present invention, by presetting a predetermined humidity value in the system, the system compares the laundry humidity value detected by the humidity detecting device with the predetermined humidity value, and when both values are consistent, it enters the thread thrum flushing program, so that the time when to enter the thread thrum flushing program can be controlled effectively, thereby to avoid an undesirable laundry drying effect caused when the flushing program starts too early, or an undesirable flushing effect caused when the flushing program starts too late.

[0010] Preferably, the predetermined humidity value is set at 10%. It has been shown by experiments that, during the drying program, the generation of the fluff from the laundry is relatively considerable when the laundry humidity is at 10%, therefore setting the predetermined humidity value at 10% can more effectively prevent the generation of the fluff of laundry, and in the case of less generation of the fluff, it is easier to improve the flushing effect, and to ensure the condensing effect of the condensing assembly, thereby ensuring the drying efficiency.

[0011] Preferably, the flushing program comprises two stages including a first flushing stage and a second flushing stage. By way of the first flushing stage, the surface of the condensing assembly in contact with the air is wetted by the water provided by this flushing stage, therefore the fluff is collected more easily when passing through the wetted condensing assembly, thus preventing the fluff from attaching directly to the condensing assembly, and at the same time reducing the possibility for the fluff to enter the blowing device and the heater; then by way of the second flushing stage, the fluff collected on the

surface of the wetted condensing assembly are flushed away.

[0012] Preferably, the sum of water consumptions in both the first and second flushing stages is not more than 3 liters, which can avoid the water waste and at the same time ensure the flushing effect.

[0013] Preferably, water intermittently filled in both the first and second flushing stages, so as to improve the flushing effect.

[0014] Preferably, a water intake speed during the first and second flushing stages is set between 8 L/min and 10 L/min, so as to have a higher flow speed for the water intake during the flushing program, and ensure the flushing effect thereof more effectively.

[0015] Preferably, between the first flushing stage and second flushing stage a step is set for determining whether the drying program is completed, and if it is, it enters the second flushing stage; otherwise, it continues with the drying program. In accordance with the differences of laundry materials and laundry amount, various drying programs are normally set so as to meet different laundry drying degrees demanded by a user; by way of this step, according to the drying program selected by the user, the system needs to determine when the drying program is to be ended so as to ensure the corresponding drying effect.

[0016] More preferably, during the second flushing stage, the blowing device is set in a normal operation status, so that air in the circulating loop forms an air flow, and under the effect of both the air flow and flushing water, the flushing effect can be ensured more effectively.

Brief Description of the Drawings

[0017] The present invention will be further described hereinbelow in combination with the drawings and embodiments.

Fig. 1 is a schematic view of a conventional laundry washing device fitted with a drying program;

Fig. 2 is a schematic view of a laundry treatment device having a drying program according to the present invention; and

Fig. 3 is a schematic flowchart of a method for controlling the laundry treatment device according to the present invention as shown in Fig. 1.

Description of the Preferred Embodiments

[0018] According to a laundry treatment device having drying program 1 in an embodiment of the present invention, since a drum-type washing and drying machine approximates to a drum-type drying machine in terms of its drying module, a drum-type washing and drying machine will be described below as an example. As shown in Fig. 2, the drum-type washing and drying machine comprises a water tub 2 and a rotatable drum 3 disposed inside the water tub 2; a heating assembly 4 disposed above the water tub 2, and comprises heating device 8 and a heating channel 9; an opening 22 for a user to access the laundry is disposed on the side of the water tub 2 and drum 3 facing the user, and an outlet 10 of the heating channel 9 communicates with the inside of the water tub 2 and the drum 3 disposed within the water tub 2 via the opening 22 or another opening disposed above the opening 22 (not shown). An air discharge opening 18 is disposed in a suitable place below one side of the water tub 2, and the air discharge opening 18 is connected to a condensing assembly 5, which comprises a condensing channel 11 and a condensing device 12. An inlet 13 of the condensing channel 11 communicates with the air discharge opening 18, and an outlet 14 of the condensing channel 11 communicates with an inlet of a blowing device 6. The blowing device 6 comprises a fan 16 and a motor 17 for driving the fan 16. An outlet of the blowing device 6 is connected with an inlet of the heating channel 9. The heating channel 9, water tub 2, drum 3 and condensing channel 11 form a circulating loop for the air flow.

[0019] In the drying program, air is heated into dry hot air by the heating device 8, and is transferred to the inside of the drum 3 via the heating channel 9, and heat exchange occurs between the dry hot air and the laundry inside the drum 3, thus the moisture in the laundry is carried away by forming relatively humid air; under the action of the fan 16, the humid air formed after the heat exchange with the laundry enters the condensing channel 11 via the inlet 13 of the condensing channel 11; by way of the condensing effect of the condensing device 12, the moisture in the humid air is condensed, and then the air re-enters the heating channel 9 of the heating assembly 4, and is heated again by the heating device 8 and transferred to the drum 3; after a number of cycles, the moisture in the laundry is dried gradually, thereby realizing the laundry drying function. The condensing device 12 can use water to condense, and can also use air to condense or use other medium to condense. For a water-cooled condensing device, condensing water feeding device 19 are normally disposed between the condensing device 12 and the fan 16, and the condensing water feeding device 19 communicates with water supplying device (not shown) of the washing device via a control valve 20. When it is necessary to supply the condensing water in the drying program, the system controls the opening of the control valve 20; when it is not necessary to supply the condensing water, the system controls the closure of the control valve 20. A spraying device 7 are further disposed between the condensing device 12 and the fan 16, and one end of the spraying device 7 is connected with the water supplying device of the washing device via a control valve 21, while the other end is disposed in the condensing channel 11 between the condensing device 12 and the fan 16; the flow speed of the spraying device 7 is controlled by the control valve 21. Indeed, the spraying device 7 can also be replaced by

the condensing water feeding device 19; namely in the flushing program, it is effected by controlling the control valve 20 to further control the opening and closing of the condensing water feeding device 19 and the speed of the water intake, thereby realize flushing function as that performed by the spraying device 7. By way of the flushing effect of the water provided by the spraying device 7, the fluff accumulated on the condensing device 12 are flushed away, thereby effectively prevent the fluff from accumulating on the condensing device 12 thus to ensure the drying efficiency.

[0020] The control method for controlling the laundry treatment device is described hereinbelow according to a schematic flowchart thereof as shown in Fig. 3.

[0021] Firstly, a drying process of a conventional drying program will be described briefly hereinafter. Referring to Fig. 1, according to the command input by a user, the system enters the drying program directly or after a washing program (including washing, rinsing and dewatering), and the system drives the heating device 8 to operate so as to heat the air into dry hot air, and at the same time it drives the motor 17 of the blowing device 6 to drive the fan 16; by blowing of the fan 16, the dry hot air is transferred to the inside of the drum 3 via the heating channel 9, and makes adequate contact with the laundry to be dried and effects heat exchange within the drum 3, thus the moisture contained in the laundry is carried away so as to form the relatively humid air which is discharged into the condensing channel 11 via the air discharge opening 18 of the water tub 2 and makes contact with the condensing device 12 in the condensing channel 11. Under the condensing effect of the condensing device 12, the moisture in the relatively humid air is condensed into water and flows back into the water tub 2 along the condensing channel 11. Since the volume of the condensed water is relatively small, it will not enter the drum 3 to make contact with the laundry. The condensed air enters the heating channel 9 under the effect of the fan, and under the effect of the heating device 8 is changed again into dry hot air which is transferred to the drum 3 to perform a heat exchange with the laundry, thereby forming a circulating loop. With the continuous air circulation, the moisture contained in the laundry is gradually carried away by the dry hot air and then is condensed into the water, which is discharged via a drain channel (not shown) located at the bottom of the water tub 2.

[0022] According to the embodiments of the present invention, when the drying program reaches a certain predetermined stage, the stage can be controlled by detecting the moisture contained in the laundry (i.e. humidity) with a temperature sensor, a humidity sensor or other similar sensing device, and it can also be controlled by a simple timer, namely it is assumed that the drying program of the system reaches the above predetermined stage after it has run for a certain time. Since the above control method is in the prior art known by those skilled in the art, it will not be further described herein, and in the embodiment of the present invention only the control by way of a humidity sensor is taken as an example. It has been shown by experiments that, when the humidity is at 10%, the laundry begins to generate the fluff, therefore as a preferred embodiment in the embodiments of the present invention, when the humidity sensor detects that the humidity inside the drum is at 10%, the drying program enters the flushing program, and at the same time the drying program continues to run. Preferably, it enters the first flushing stage first. The system opens the control valve 21, and the water is charged into the condensing channel 11 by the spraying device 7 and sprayed onto the surface of the condensing device 12 under the effect of the control valve 21, thus the surface of the condensing device 12 is wetted so as to form a water layer on the surface of the condensing device 12. The fluff comes from the laundry in the drying process are carried to the condensing channel 11 under the effect of the running air, and attaches to the water layer of the surface of the condensing device 12. Due to the affinity interaction of the water layer, this can prevent the fluff from entering the blowing device 6 and heating channel 9 via the condensing channel 11. The first flushing stage stops after it has continued for a certain time or a certain volume of water has been charged, and then the system determines whether the drying program is completed according to the detected humidity of the laundry, namely when the laundry drying degree is consistent with the drying degree corresponding to the input command by the user, the system determines that the drying program is completed; otherwise, it continues with the drying program. When the system determines that the drying program has been completed, it enters the second flushing stage, namely the system opens the control valve 21, and the water is charged into the condensing channel 11 by the spraying device 7 and sprayed onto the surface of the condensing device 12 under the effect of the control valve 21; the fluff accumulated on the surface of the condensing device 12 are flushed away by the flushing effect of the water flow. The second flushing stage ends after it has continued for a certain time or a certain volume of water has been charged until the whole drying program ends, thus ensuring the fluff are fully flushed away; the flushed fluff flows with the water back into the water tub 2, and then is discharged directly by a drain pump via the drain channel of the water tub 2, or it is possible to fit a filter device in the drain channel to filter the fluff, and then it can be cleaned regularly by the user. More preferably, during the second flushing stage, the air-blasting device 6 are set in a normal operation status, namely the fan 16 is in a normal rotation status under the drive of motor 17, such that the air in the circulating loop forms the air flow, and under the effect of both the air flow and flushing water, the flushing effect can be ensured more effectively.

[0023] It is shown according to the experimental results that the sum of water consumption in both the first and second flushing stages should not be too small, otherwise the fluff will not be flushed away cleanly; while also should not be too much, otherwise it will result in water

waste. Preferably, the sum of water consumption in both the first and second flushing stages is not more than 3 liters, so as to avoid the water waste while ensuring the flushing effect. More preferably, in order to improve the flushing effect, the water intake of the spraying device 7 is controlled by the control valve 21 to be intermittent. In addition, in the flushing program, if the water intake speed of the spraying device 7 is too slow, the flushing effect on the fluff will not be ideal; with definite water volume, if the flow speed is too high and the flushing time is too short, the flushing effect will also not be ideal, therefore the water intake speed of the first flushing stage and second flushing stage is set between 8 L/min and 10 L/min, and this can ensure the flushing effect thereof more effectively.

[0024] In summary, within the scope of basic technical idea of the present invention, all forms of variations by those skilled in the art relevant to the technical field of the present invention as disclosed are within the protection scope of this patent application for the present invention.

Claims

1. A laundry treatment device having a drying program (1), comprising a water tub (2), a rotatable drum (3) disposed within the water tub (2), a heating assembly (4) for heating air into dry hot air, a condensing assembly (5) for condensing moisture contained in relatively humid hot air, and a blowing device (6) for driving an air circulation, wherein an air circulating loop is formed among said heating assembly (4), water tub (2), drum (3), condensing assembly (5) and blowing device (6), **characterized in that** a spraying device (7) for flushing fluff accumulated on said condensing assembly (5) are disposed between said condensing assembly (5) and said blowing device (6).

2. A method for controlling the laundry treatment device having a drying program as set forth in claim 1, **characterized in that** said drying program comprises a flushing program for flushing the fluff accumulated on said condensing assembly (5) by said spraying device (7).

3. The method for controlling the laundry treatment device as claimed in claim 2, **characterized in that,** before said flushing program, further comprises a humidity detecting stage, wherein when the humidity detected in said humidity detecting stage reaches a predetermined humidity value, it enters the flushing program; otherwise, it continues with the drying program.

4. The method for controlling the laundry treatment device as claimed in claim 3, **characterized in that** said predetermined humidity value is set at 10%.

5. The method for controlling the laundry treatment device as claimed in one of claims 2 to 4, **characterized in that** said flushing program comprises two stages which are a first flushing stage and a second flushing stage.

6. The method for controlling the laundry treatment device as claimed in claim 5, **characterized in that** the sum of water consumptions in both said first and second flushing stages is not more than 3 liters.

7. The method for controlling the laundry treatment device as claimed in claim 5 or 6, **characterized in that** water intake of both said first and second flushing stages is intermittent.

8. The method for controlling the laundry treatment device as claimed in one of claims 5 to 7, **characterized in that** a water intake speed during said first and second flushing stages is set between 8 L/min and 10 L/min.

9. The method for controlling the laundry treatment device as claimed in one of claims 5 to 8, **characterized in that** between said first flushing stage and second flushing stage a step is set for determining whether the drying program is completed, and if it is, it enters the second flushing stage; otherwise, it continues with the drying program.

10. The method for controlling the laundry treatment device as claimed in claim 9, **characterized in that,** during said second flushing stage, said blowing device (6) is set in a normal operation status.

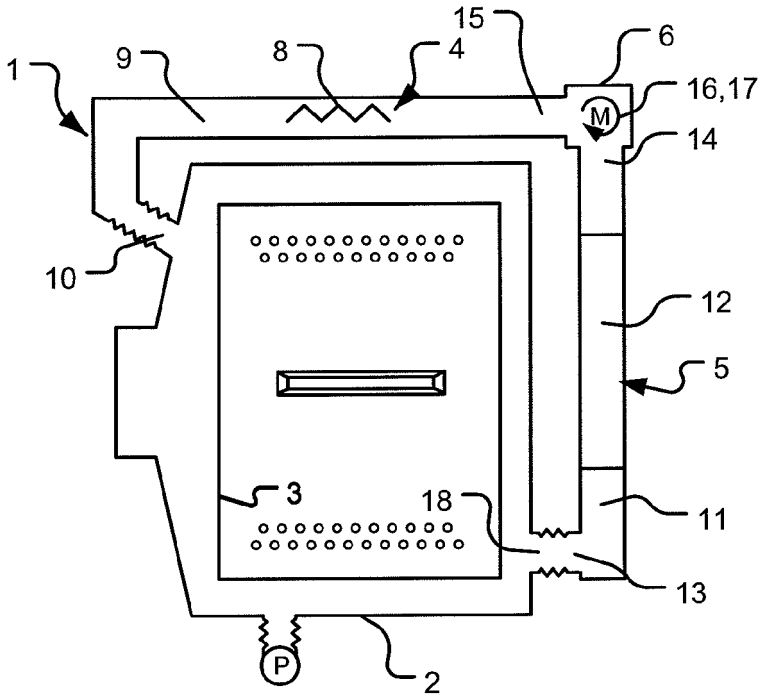
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Fig.1

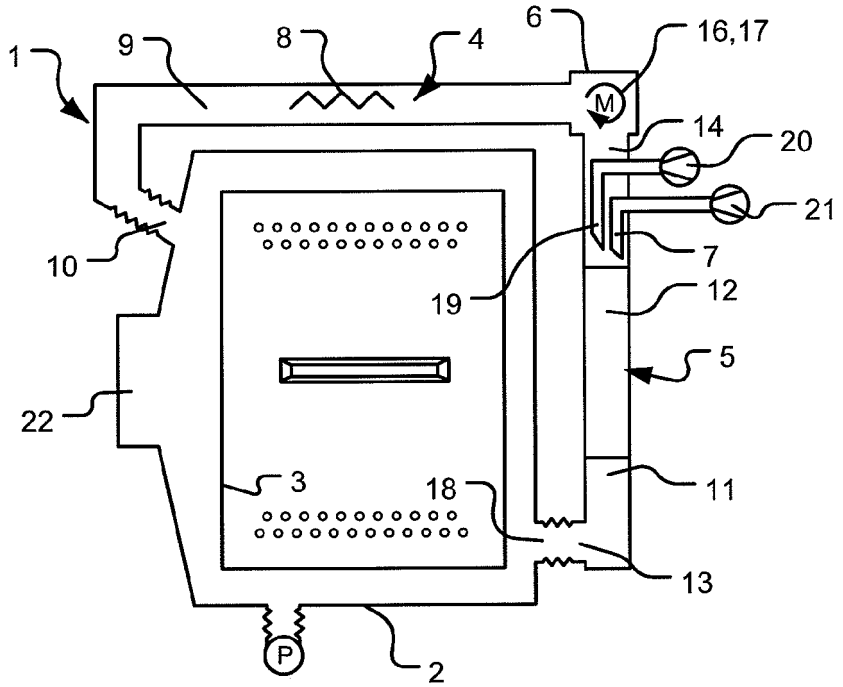
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Fig.2

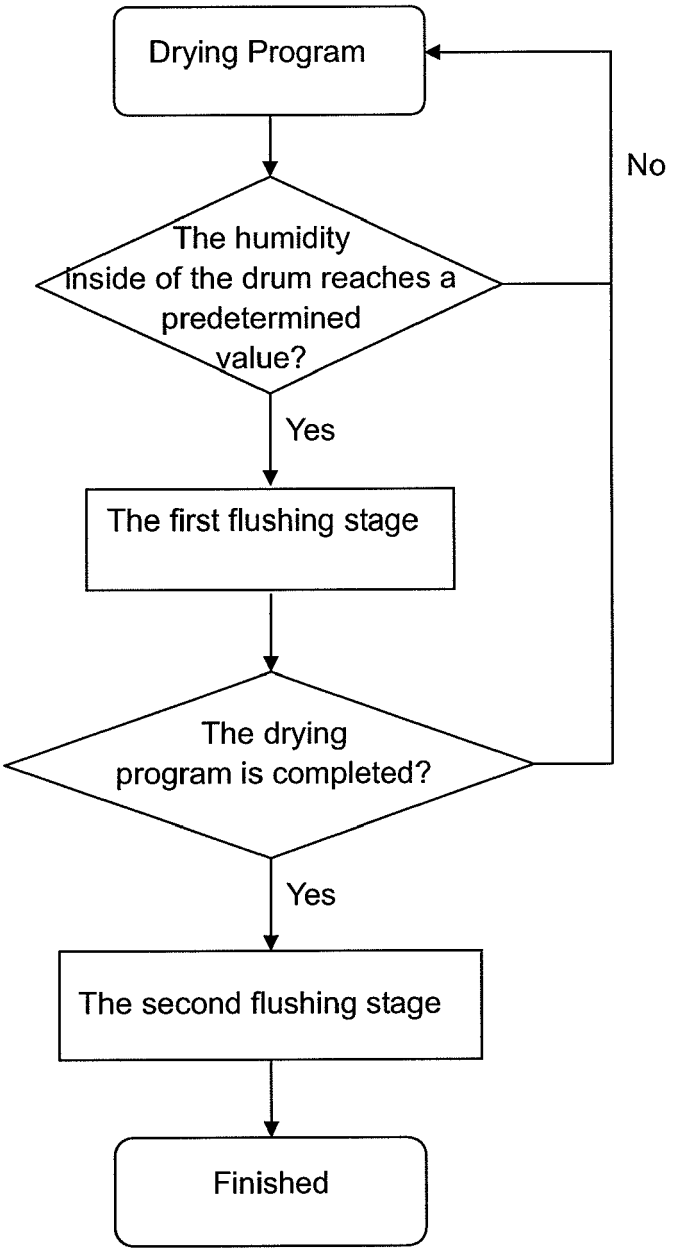
Drying Program
No
The humidity inside of the drum reaches a predetermined value?
Yes
The first flushing stage
The drying program is completed?
Yes
The second flushing stage
Finished

Fig.3

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EUROPEAN SEARCH REPORT

Application Number
EP 08 10 5292

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 100 02 743 A1 (WHIRLPOOL CO [US]) 2 August 2001 (2001-08-02) * abstract * * column 1, line 52 - line 64 * * column 2, line 30 - line 32 * * column 4, line 5 - line 16 *	1,2,5,9, 10	INV. D06F58/22
A	US 2 941 389 A (MORRISON HAROLD E) 21 June 1960 (1960-06-21) * column 3, line 50 - line 73; figure 1 *	1-10	
A	DE 37 38 031 A1 (BOSCH SIEMENS HAUSGERAETE [DE]) 18 May 1989 (1989-05-18) * column 2, line 26 - line 52; figures 1-3 *	1-10	
A	EP 0 636 732 A (BOSCH SIEMENS HAUSGERAETE [DE]) 1 February 1995 (1995-02-01) * abstract; claim 1; figures 1,2 *	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 December 2008	Westermayer, Wilhelm

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
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1

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 10 5292

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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16-12-2008

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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